

Ball and Socket Joint, Preferably for Use in Vehicles

The present invention pertains to a ball and socket joint, preferably for use in vehicles, especially in the area of the chassis of motor vehicles, with a ball and socket joint housing having a joint opening, with a ball pivot, which is arranged in the ball and socket joint housing, extends through the joint opening and with which a shaft is made integral, with a support ring arranged on the shaft of the ball pivot and with a sealing element, which is arranged between the support ring and a connection component surrounding the shaft of the ball pivot, according to the preamble of claim 1.

It is usually necessary in ball and socket joints to guarantee the relative motion of the joint parts in relation to one another without limitations of the function at least over a service life preset for the type of ball and socket joint in question. There must be sufficient sealing against external effects, especially against the penetration of foreign bodies and moisture. Support rings, which are arranged on the ball pivot of the ball and socket joint and on which the pivot-side sealing labyrinth of a sealing bellows can be sealingly fixed, are used for this purpose.

A ball and socket joint for motor vehicles, which has a gasket made of an elastically deformable material between the housing of the ball and socket joint and a ball pivot carrying the joint ball, is known in this connection from DE-OS 37 05 847. A support ring, which is arranged adheringly on the ball pivot and meshes with the bearing surface of the gasket in a positive-locking manner, is inserted between the bearing surface of the gasket and the ball pivot.

Sealing is brought about in this solution in the area of the support ring by the support ring being provided with a coating consisting of an elastic material.

Furthermore, a ball and socket joint, which comprises essentially a ball pivot and a ball socket for holding the head of the ball pivot with a bearing inserted in between, is known from DE 103 00 678 A1. Furthermore, the ball and socket joint has a retaining ring, which comprises a cylindrical part, which is arranged on an outer circumferential surface of the shaft of the ball pivot, and a flange, which projects from one end of the cylindrical part of the retaining ring and comes into close contact with a fastening bead of a sleeve.

In connection with this teaching, the area in which the retaining ring is arranged on the shaft of the ball pivot is filled with a sealant, which penetrates as a liquid into recesses in this area.

The basic object of the present invention is to perfect a ball and socket joint such that its ability to function is preserved over comparatively long periods of time regardless of the specific design of the joint, without being adversely affected by corrosion phenomena in the area of the ball pivot.

The object is accomplished according to the present invention on a ball and socket joint of the type described by the sealing element used to seal the shaft of the ball pivot being designed as an elastically and/or plastically deformable profiled body, whose effective cross section, which is free from the effect of forces, is limited by a continuously extending, curved contour, which is subject to deformation in the installed state, as a result of which a partial area of the contour is in contact with the adjacent areas that are to be sealed.

The present invention is associated with the advantage that based on the given elastic and/or plastic deformability of the profiled body, the material properties and the geometric shape of the profiled body, such as the contour of the cross section, can be selected in a specific manner such that the required sealing action is achieved depending on the installation position and the pretension exerted on the profiled body.

To embody a selective sealing function of the sealing element designed as a profiled body, the elastically and/or plastically deformable profiled body has a profiled basic body and sealing segments in the embodiment of the present invention. The sealing segment in question can thus be specially adapted to the sealing function to be ensured in the particular case, among other things, by selecting the manner of its arrangement and its connection with the profiled basic body. At least some of the sealing segments preferably extend here essentially in the radial direction relative to the profiled basic body.

To control the deflection behavior of the sealing segment in a use-dependent manner, optionally for achieving a corresponding response behavior for a certain number of sealing segments, transition areas, which are shaped and whose material is selected such that elastic and pretension-related deflection of the sealing segment adjoining the particular transition area is ensured, may be provided for connecting the profiled basic body with the sealing segments.

In a preferred embodiment of the present invention, the profiled body has a connection surface, via which the profiled body is connected to an adjoining component.

The adjoining component is preferably a support ring, which is to be arranged on the ball pivot of the ball and socket joint. The connection between the profiled body and the support ring may be established by vulcanization or by bonding.

It is also possible to position the profiled body on the shaft of the ball pivot or the support ring in preparation for the mounting of the ball and socket joint. The profiled body may be expediently positioned as a result of a radial expansion of the profiled body by positive locking and/or non-positive locking on the component in question.

In another preferred embodiment of the present invention, the support ring has a radially extending flange, with which at least one sealing segment of the profiled body is in contact under pretension. In addition as well as as an alternative hereto, at least one sealing segment of the profiled body may be in contact with the radially outer front surface of the flange of the support ring under pretension, so that a redundant sealing system can be created on this basis.

To create defined elasticity and sealing conditions, the profiled body may have stabilizing elements, which may be designed as a strip or round bars and are used to stabilize the core structure of the transition areas to the sealing segments and the sealing segments themselves.

The present invention shall be explained in more detail below on the basis of an exemplary embodiment and corresponding drawings.

In the drawings,

Figure 1 shows a synoptic view of a hinge joint designed as a ball and socket joint with a profiled body according to the present invention,

Figures 2-4 show views of detail X according to Figure 1 with profiled bodies, which are installed and are thus in the pretensioned state and are different from one another in terms of their cross-sectional contours, and

Figure 5 shows a sectional view of other, non-pretensioned profiled bodies.

The hinge joint shown schematically in Figure 1 is a ball and socket joint with some features known per se to the person skilled in the art. The presentation of the design of the ball and socket

joint can therefore be limited to the most important elements.

The ball and socket joint comprises essentially a ball pivot 1, a bearing shell 2 and a housing 3, which surrounds the ball pivot 1 and the bearing shell 2 at least partially. The ball and socket joint is sealed in the transition area from the housing 3 to the ball pivot 1 by a sealing bellows 4, which is held in the sealing position by means of the support ring 5, the round straining ring 6 and the flat straining ring 7 and makes possible a change in the relative position of the ball pivot 1 in relation to the housing 3.

The housing 3 is, itself, of a two-part design and comprises a housing basic body 8 and a closing cover 9, which closes the housing 3 on the side facing away from the ball pivot 1 after the insertion of the ball pivot 1 into the housing basic body 8.

The ball pivot 1 has a conically extending shaft 10, which is connected to a connection component 11 in a positive-locking and non-positive manner and carries the support ring 5, which is in turn formed from a basic web 12 that is in contact with the shaft 10 of the ball pivot 1 and a flange 13 extending at an angle to the basic web 12.

The flange 13 of the support ring 5 and a reference surface 14 of the connection component 11 are separated at least partially by a pretensioned sealing element, which is designed as a profiled body 15. Since the sealing action of the profiled body 15 develops at a radially spaced location from the circumferential surface of the shaft 10 of the ball pivot 1, effective protection of the ball pivot 1 against corrosion is achieved.

Figures 2 through 4 show different profiled bodies 15 in both the tension-free state and the pretensioned installed position in the ball and socket joint. They comprise a profiled basic body

16 each with transition areas 17, which are joined by sealing segments 18. The continuously extending contour 19 of the sealing cross section of the profiled body 15, which contour is relevant for the sealing action, is determined by the sealing segments 18. For example, an especially efficient sealing action is achieved in the case of the profiled body 15 shown in Figure 2
5 by the two radially outer sealing segments 18 forming together a first barrier produced between the flange 13 of the support ring 5 and the reference surface 14 of the connection component 11 and by there being multiple redundancy due to the fact that a third and fourth sealing segment 18 are sealingly in contact with the shaft 10 of the ball pivot 1 under pretension.

Sealing of the shaft 10 of the ball pivot 1 is achieved in profiled bodies 15 provided with sealing
10 segments 18 essentially by compression or bending of the sealing segment 18 in question, which takes place under the action of force, and, in the presence of transition areas, by a deflection of the sealing segments 18 as a consequence of the elastic properties of the transition areas 17.

The sealing segments 18 have large volumes in the profiled body 15 shown in Figure 3, which has an elongated design, so that a sealing segment is brought two-dimensionally into contact with the
15 shaft 10 of the ball pivot 1, on the one hand, and the sealing segment 18 located opposite this extends around the flange 13 of the support ring 5 and comes into contact with the front surface 20 of the flange 13, on the other hand.

Regardless of the embodiment selected, it is within the scope of the present invention to combine sealing segments 18 of different shapes on a profiled body 15 in order to achieve the desired
20 sealing action at the particular sealing position of the sealing segment 18 and to create a redundant sealing system by the cooperation of the sealing segments 18.

The peculiarity of the profiled body 15 shown in Figure 4 is especially that the transition areas 17

pass over into the profiled basic body 16 and into the sealing segments 18 with continuously extending radii of curvature, so that the sealing action of the entire profiled body 15 is also determined by the elastic properties of the profiled basic body 16.

Figure 5 shows a selection of other preferred cross-sectional shapes of profiled bodies 15, which makes it possible to obtain an efficient sealing action. Shapes that contain sealing segments 18 and transition areas 17 to the profiled basic body 16 as desired as well as shapes in which sealing segments 18 may be omitted with respect to the application of the profiled body 15 have been selected. Depending on the concrete application and the desired sealing action, it is within the scope of the present invention to provide the profiled bodies 15 with stabilizing elements 21.

Based on the sealing elements presented within the framework of the present invention, which are designed as profiled bodies, it is possible to select the particular, suitable sealing element as a function of the site of installation of the ball and socket joint and the necessary sealing function.

List of Reference Numbers

- 1 Ball pivot
- 2 Bearing shell
- 3 Housing
- 4 Sealing bellows
- 5 Support ring
- 6 Round straining ring
- 7 Flat straining ring
- 8 Housing basic body
- 9 Closing cover
- 10 Shaft
- 11 Connection component
- 12 Basic web
- 13 Flange
- 14 Reference surface
- 15 Profiled body
- 16 Profiled basic body
- 17 Transition areas
- 18 Sealing segments
- 19 Contour
- 20 Front surface
- 21 Stabilizing element